EPA Environmental Technology Partnerships

Environmental Cleanup

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Cooperative Research and Development Agreement With Exxon Company, U.S.A.

Bioremediation of Oil in Prince William Sound, Alaska

Participants

This Cooperative Research and Development Agreement (CRADA) was an interactive effort involving scientists from the U.S. Environmental Protection Agency (EPA) and Exxon Company, U.S.A.

Purpose

This Agreement was designed to demonstrate the feasibility of accelerating the rate of biodegradation of oil spill residues on the shorelines of Prince William Sound, AK, and, as a result, identify bioremediation techniques for future spills.

Background

In March of 1989, the supertanker *Exxon Valdez* ran aground on a reef in Prince William Sound, AK. Within 3 days approximately 11 million gallons of crude oil had spilled from the vessel, contaminating an estimated 300 miles of shoreline in the Sound.

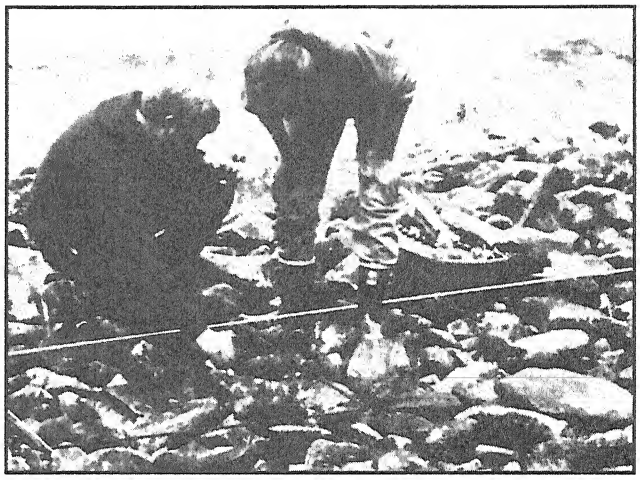
To enhance cleanup efforts, EPA's Office of Research and Development (ORD) suggested that bioremediation might prove useful in cleaning the shoreline following physical washing. In June of 1989, ORD entered into a CRADA with Exxon to study the feasibility of bioremediation.

Procedures

Oil bioremediation technologies typically use the stimulation of naturally-occurring, hydrocarbon-degrading microorganisms, usually by addition of oxygen and/or fertilizer, to degrade oil. Such organisms are capable of breaking down hydrocarbons to obtain food and energy, producing mainly carbon dioxide, water, salts, and microbial biomass.

Using this approach, fertilizer application at Prince William Sound began on June 9, 1989. Three types of fertilizers were applied:

- A slow-release, water-soluble fertilizer, in which nutrients were distributed to the oil-contaminated beach surfaces by rain and tidal action. This method employed commercially-available fertilizer granules which when added to the beaches, stuck to the oil.



Researchers study nutrient-treated plot for signs of biodegradation.

- A commercial liquid oleophilic fertilizer, in which the nutrients adhered to the oil covering the rock and gravel surfaces, thereby making nitrogen and phosphorous available at the site of microbial activity. This fertilizer was manually sprayed over the contaminated areas.

- A third type of fertilizer, a solution containing inorganic nitrogen and phosphorus dissolved in seawater, was sprayed across the beaches by fixed sprinkler systems (similar to lawn sprinklers).

Results

By July 15, 1989, EPA's demonstration had shown that bioremediation was having a significant visible effect on the amount of oil remaining on the test beaches, and later data analysis demonstrated the extent of biodegrdation enhancement that had been obtained by fertilizer application. By the end of September 1989, Exxon had treated 74 miles of shoreline in the largest bioremediation project ever conducted.

Findings from both field and laboratory tests initiated under this CRADA indicate that using nutrients to enhance biodegradation of oil-contaminated sites was effective and environmentally safe.

Benefits to Government and Industry

The methods developed in Alaska by EPA in conjunction with Exxon have elevated bioremediation as a credible cleanup solution both within EPA and the private sector. Information gained through application of these techniques will become important as future oil spills occur and in establishing standardized methods for measuring microbial activity and oil degradation in the field that can be applied to the bioremediation of other hazardous wastes.

This is one of more than 50 cooperative research and development agreements EPA has with various U.S. businesses, academic institutions, and state and local governments under the Federal Technology Transfer Act of 1986. These agreements serve as a mechanism for the federal government to work with private industry and others to develop new pollution prevention and control technologies and efficiently bring them into the marketplace.

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